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## USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

## GEOPHYSICS, ASTRONOMY AND SPACE

No. 428

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CONTENTS	PAGE
I. ASTRONOMY.....	1
News.....	1
Notes on Results Obtained Using RaTAN-600 Radio Telescope.....	1
Abstracts of Scientific Articles.....	3
Atmospheres of Planetary Satellites.....	3
Light Reflection by Space Objects with Mirror Surface.....	3
II. TERRESTRIAL GEOPHYSICS.....	4
Abstracts of Scientific Articles.....	4
Prediction of Petroleum and Gas on Young Platforms.....	4
Acoustic Method for Investigating Boreholes for Mineral Deposits..	4
Deep Structure of Estonia Determined by Earthquake Exchange Waves Method.....	5

	<u>Page</u>
Method for Determining Recent Horizontal Block Movements.....	6
Classification of Faults in the Baykal Mountainous Region.....	7
Geochronology of Bottom Sediments in Black Sea.....	7
Increasing Effectiveness of Exploration for Petroleum and Gas...	8
Aerophotogeological Mapping of Areas Covered by Sediments.....	9
Methods for Increasing the Accuracy of a Ballistic Gravimeter...	9
Equivalence Problems in Inverse Gravimetry Problem.....	10
Electrometry Induction Methods for Petroleum and Gas Boreholes..	10
Response of Ballistic Gravimeter to Vertical Movements of Base..	11
Mechanism of Barrier Source of Transverse Waves.....	11
Velocity of Elastic Waves in Ural Bauxites.....	12
Vertical Extent of Alkaline Bodies and Complexes.....	12
Curvature of Front of Seismic Wave in Layered-Gradient Medium...	13
III. UPPER ATMOSPHERE AND SPACE RESEARCH.....	14
News.....	14
"Salyut-6" Mission Exploited by "Priroda" Center.....	14
Chronology of "Salyut-6" Mission 23 July-4 August 1978.....	15
TASS Announces Launching of "Kosmos-1028".....	17
Origins of Life Sought in "Salyut-6" Experiments.....	18
Psychological Support for "Salyut-6" Mission Cosmonauts.....	18
Commentary on "Progress-2" Mission.....	20
"Salyut-6" Mission EVA Described.....	21
Commentary on "Salyut-6" Food Selection.....	24

	<u>Page</u>
Abstracts of Scientific Articles.....	26
Sun's Magnetic Field as Source of Cosmic Ray Modulation.....	26
Error in Representing Figure of Geoid for Evaluating AES Position.....	27
Coordinate Systems for Mapping Planets and Space Navigation....	27
Refining Topographic Direction of Artificial Satellites.....	28
Effect of Light Scattering on Choice of Spectral Zones.....	28
IV. MISCELLANEOUS.....	30
News.....	30
Official Previews 24th Soviet Antarctic Expedition.....	30

## I. ASTRONOMY

### News

#### NOTES ON RESULTS OBTAINED USING RATAN-600 RADIO TELESCOPE

Moscow IZVESTIYA in Russian 9 Aug 78 p 4

[Article by Yu. Pariyskiy: "Unsolved Secrets of Nature"]

[Abstract] The RATAN-600, the world's largest reflecting radio telescope, constructed near Zelenchukskaya station, continues to yield new findings. More than 5,000 of the most diversified observations have already been made. The radio telescope operates around-the-clock, simultaneously in accordance with several scientific programs. The results obtained in the fields of solar, planetary, galactic and extragalactic radioastronomy are discussed extensively at all-union and international symposia, conferences and congresses. The most unexpected finding was the discovery of intensive radioemission of Io, the satellite closest to Jupiter. Usually the total energy radiated by a satellite is equal to the energy received from the sun. But it is different with the Jovian satellites: they radiate more energy than is received from the sun. This is a mystery which scientists are attempting to solve. One of the most widely accepted hypotheses is that the entire system of Jovian satellites (there are 13 satellites), together with the planet, can be regarded as a miniature solar system. The evolution of the Jovian system duplicates the evolution of the solar system. According to this hypothesis, Jupiter was formed from a dust cloud; compressing and accelerating its rotation, this cloud was the source of a central dense body (Jupiter) and small formations (satellites). During compression of the central body the temperature increased at its center and it was transformed into a small star, which heated the satellites surrounding it. Now Jupiter has almost cooled but the satellites still have retained the heat. The fact is that if Io radiated as an ordinary heated body the intensity of the radiation at short radio wavelengths would be greater than at long wavelengths. But observations with the RATAN have shown the reverse. One of the explanations which can be proposed is that this satellite has a magnetic field and powerful radiation belts...Investigations of the nucleus of our Galaxy with the RATAN-600 have been carried out since 1974. The RATAN radioimage differs considerably from all those obtained earlier with less modern instruments.

It was possible to determine a great number of physical characteristics of the galactic nucleus: temperature and the density of the hot gas in it, distribution of the gravitational potential, which reflects the distribution of the total mass in the nucleus, mean luminosity and even the mean spectral class of the star concentration around the very center of our Galaxy. The observations with this radio telescope did not indicate any remarkable properties of the nucleus. There it was possible to observe a very dense (a million times denser than in the neighborhood of the sun) concentration of very old stars, the age of which is billions of years, and possibly several tens of young stars. At the very center of this star concentration there is a unique point source but the intensity of its emission is very small and its mass is thousands of times less than the mass of the star concentration. This circumstance evidently precludes the possibility of a powerful explosion in the galactic nucleus and the transformation of our Galaxy into a gigantic radiogalaxy.

[528]



## Abstracts of Scientific Articles

### ATMOSPHERES OF PLANETARY SATELLITES

Moscow ASTRONOMICHESKIY VESTNIK in Russian Vol 12, No 2, 1978 pp 96-100

[Article by A. F. Steklov, Main Astronomical Observatory Ukrainian Academy of Sciences, "Atmospheres of Planetary Satellites. II. Maximum Admissible Temperature of Exospheres of Galilean Satellites of Jupiter"]

[Abstract] Using two independent methods the author has ascertained the maximum admissible temperatures of the exospheres for the Galilean satellites of Jupiter. If the present-day estimates of the exospheric temperature of Io are correct, the satellite atmosphere is unstable to dissipation and cannot exist without a gas source. It is shown that the methane atmosphere of Titan is unstable to dissipation if the mean temperature of the atmosphere is greater than  $130^{\circ}\text{K}$ . It is therefore clear that the atmosphere of the Galilean satellites must be exceedingly dynamic since the flux of dissipating particles changes by an order of magnitude with a change in  $T_{\text{cr}}$  by  $20\text{--}30^{\circ}\text{K}$ . Future studies of the satellites should concentrate on investigations of temperature variations of their surfaces and atmospheres. The following aspects of the problem were examined in this paper and must be reassessed as new data become available: physical properties of exospheres and their changes, determination of dissipation of neutral particles, dissipation of charged particles, effect of solar wind on gas dissipation, dissipation of gas from exosphere, beginning from surface, determination of characteristic times of gas dissipation.

[432]

### LIGHT REFLECTION BY SPACE OBJECTS WITH MIRROR SURFACE

Moscow ASTRONOMICHESKIY VESTNIK in Russian Vol 12, No 2, 1978 pp 107-119

[Article by V. M. Grigorevskiy and S. Ya. Kolesnik, Odessa Technological Institute, "Light Reflection by Space Objects with Regular Mirror Surface"]

[Abstract] The purpose of this article is the derivation of precise formulas describing the mirror reflection of light from a sector of a convex regular surface which can consist of elliptical, parabolic points and "flattening" points. The solution of this problem is realized in the form of formulas (30), (38), (43), (46) and (47) which are derived in this paper. Simplified variants of the mentioned formulas are presented for approximate practical computation of different problems encountered in actual practice. An example is given of the application of the results of this study. The simplified formulas, (52)–(59), it is pointed out, are quite convenient in specific cases but cannot compare in accuracy with the basic formulas.

[432]

## II. TERRESTRIAL GEOPHYSICS

### Abstracts of Scientific Articles

#### PREDICTION OF PETROLEUM AND GAS ON YOUNG PLATFORMS

Moscow SOVETSKAYA GEOLOGIYA in Russian No 5, 1978 pp 16-27

[Article by V.A. Benenson, N. P. Zapivalov, N. Ya. Kunin, I. I. Nesterov and Yu. K. Yuferov, "Principal Criteria for the Prediction of Presence of Petroleum and Gas in Pre-Jurassic Deposits on Young Platforms"]

[Abstract] An analysis of geological and geophysical data published during recent years on the West Siberian, Turan and other young platforms has made it possible to reexamine the earlier poor evaluations in predictions of the presence of petroleum and gas in Triassic and Paleozoic deposits. As a result of the broad use of seismic methods (common deep point method and refracted waves method) in combination with deep drilling data it was found that there is primarily an uninterrupted bedding of Pre-Jurassic deposits with characteristic complications in zones near faults and fractures. It is shown that there is a broad development of fine-grained rocks of marine and coastal marine genesis. The sounding cross section shows collector rocks and regional variants of covering materials. The presented materials indicate that the presence of deposits of petroleum and gas in the Paleozoic deposits in the southern part of Western Siberia and the Chu-Sarysuyskaya depression, as well as in the Triassic strata of the Mangyshlak and Cis-Caucasian regions, in combination with the favorable structural-facies characteristics, make it possible to regard the Pre-Jurassic deposits as a new and promising object in regions of young platforms.

[519]

#### ACOUSTIC METHOD FOR INVESTIGATING BOREHOLES FOR MINERAL DEPOSITS

Moscow SOVETSKAYA GEOLOGIYA in Russian No 5, 1978 pp 64-76

[Article by Ye. V. Karus and O. L. Kuznetsov, All-Union Scientific Research Institute of Nuclear Geology and Geophysics, "Acoustic Method for Investigating Boreholes in the Search for, Exploration and Exploitation of Mineral Deposits"]

[Abstract] The authors examine the principal results achieved during recent years in the USSR and abroad in the field of theory, instrumentation and methods for investigating deep boreholes. Emphasis is on the use of geoaoustics in solving the problems involved in petroleum and gas geology and geophysics. The authors set forth the principles for determining the deformation-elastic moduli of rocks and their stressed state under the conditions applicable for cased and uncased boreholes. The article defines the principal ways which can be used in developing the physical principles, methods and instrumentation used in borehole geoaoustics. For example, in the field of instrumentation the following recommendations are given: 1) there must be assurance of standard production of instrumentation for wide-band logging of cased and uncased boreholes (AKN-1) in combination with IFKD-1 apparatus and the ANK-1 measuring panel; 2) development and standard production of apparatus with improved metrological qualities designed for large-scale measurements in uncased boreholes; 3) development and production of apparatus with improved metrological qualities designed for large-scale measurements in uncased boreholes; 3) development and production of universal and standardized measuring panels with registry of the characteristics of P and S waves and also a universal indicator for the registry of phase-correlation diagrams, wave patterns of the television image and analogue curves from the screen of a cathode-ray tube; 4) creation, on the basis of standardized measuring and indicator panels, of a number of acoustic logging instruments designed for the logging of petroleum, ore and coal holes and also for geological engineering research; 5) creation and industrial testing of apparatus for registry of total acoustic signals in digital form on a magnetic carrier; 6) creation of technical means for exciting powerful acoustic fields in a borehole in the frequency range 1-50 KHz with transmission of electric energy from the surface into the borehole along a logging cable; 7) creation and introduction of technical means for the calibration of acoustic logging apparatus and acoustic cementometry using kinematic and dynamic parameters.

[519]

#### DEEP STRUCTURE OF ESTONIA DETERMINED BY EARTHQUAKE EXCHANGE WAVES METHOD

Moscow SOVETSKAYA GEOLOGIYA in Russian No 5, 1978 pp 123-129

[Article by N. K. Bulin, All-Union Geological Research Institute, "Deep Structure of Northwestern Estonia According to the Earthquake Exchange Waves Method"]

[Abstract] The article examines the methods involved and the results of detailed seismological investigations made in northwestern Estonia on the basis of data obtained by the earthquake exchange waves method in the epicentral zone of the six-unit Osmussaarskoye (Estonian) earthquake of 25 October 1976. The registry of seismic phenomena (aftershocks of the Osmussaarskoye earthquake, distant earthquakes and industrial shots) was accomplished using

four or five ASS-3 ("Cherepakha") stations in the limits of the four- to five-unit zone. Observations of PS waves are used in constructing four deep sections with a total length of 160 km. On all profiles, using data obtained by the earthquake exchange waves method, it was possible to trace the surface of the crystalline basement (depth 0.2-0.4 km), the horizon A within the granite-metamorphic layer (H 12-16 km), Conrad discontinuity (H 22-26 km) and Mohorovicic discontinuity (H 42-47 km). It has been established from observations of longitudinal waves from aftershocks that the velocities in the depth interval 10-15 km are considerably increased (6.5-6.6 km/sec) and are close to those usually used for the top of the "basalt" layer. The earthquake focus and its aftershocks are associated with a block of the thickened (up to 45-47 km) crust. The conclusion is drawn that two or three seismic stations must be established in Estonia.

[519]

#### METHOD FOR DETERMINING RECENT HORIZONTAL BLOCK MOVEMENTS

Prague GEODETICKY A KARTOGRAFICKY OBZOR in Czech Vol 24, No 2, Feb 78  
pp 28-30

[Article by Milos Cimbalnik, Geodetic Institute, Prague, "Determination of Recent Horizontal Block Movements by Geodetic Methods"]

[Abstract] Investigation of horizontal movements of individual points by the methods used in triangulation and trilateration does not yield sufficient data for determining movements of the earth's surface and for their interpretation. This is because these methods are not accurate enough and movements of points and not of whole blocks are studied. Movements of individual points relative to other points cannot be determined because when movements occur they are those of larger or smaller geological units, not movements of individual points. The accuracy of movements of individual points is increased by determination of a very large number of mutually independent data (angles and distances). When individual measurements are independent of each other values of the mean inaccuracy of the calculated vector are reduced. Movements of two or more blocks relative to one another are investigated. When the position of the individual blocks is unknown they are found using suitable computer programs. The method developed by the author can also be used for the determination of vertical movements. It can be used in triangles of the astrogeodetic network measuring tens to hundreds of meters. The method was used in a study of the Carpathian region.

[482]

## CLASSIFICATION OF FAULTS IN THE BAYKAL MOUNTAINOUS REGION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 241, No 2, 1978 pp 437-440

[Article by Yu. I. Yegorov, East Siberian Scientific Research Institute of Geology, Geophysics and Mineral Raw Materials, "New Data on the Distribution and Classification of Faults in the Baykal Mountainous Region"]

[Abstract] The author has investigated the faults in the northern part of the Baykal mountainous region, known in the literature as the Baykal-Patomskoye Highlands. This was done on the basis of a complex analysis of geological and geophysical (aerogeophysical, aeromagnetic, gravimetric surveys and deep seismic sounding) materials. New data have been obtained supplementing and refining that previously published. This has made it possible to compile a new and more complete map of faults in the region and to carry out their systemic and statistical analysis, as discussed in this paper (Fig. 1 in the text is a reproduction of the mentioned fault map). The dislocations are classified on the basis of the strike of folded structures as longitudinal, transverse and diagonal; on the basis of orientation -- northeasterly, northwesterly, sublatitudinal and submeridional; on the basis of depth -- crustal-mantle and intracrustal; on the basis of geological significance -- fault zones separating first-order blocks (folded regions and platforms); regional faults controlling second- and third-order blocks and dislocations of a higher order (intrablock dislocations). These are described in detail. There is a spatial correlation between the distribution of endogenous mineralization, including gold, polymetals and muscovite, and faults and especially their points of intersection. This correlation is manifested most clearly for high-order dislocations. This makes it possible to recommend the use of data on fault tectonics for increasing the effectiveness of metallogenetic and reconnaissance-exploration work carried out in this region.

[521]

## GEOCHRONOLOGY OF BOTTOM SEDIMENTS IN BLACK SEA

Kiev GEOLOGICHESKIY ZHURNAL in Russian Vol 38, No 4 pp 44-53

[Article by K. M. Shimkus, A. Yu. Mitropol'skiy and N. N. Kovalyukh, Southern Division Institute of Oceanology, Institute of Geological Sciences Ukrainian SSR and Institute of Geochemistry and Physics of Minerals Ukrainian Academy of Sciences, "New Data on the Geochronology of Bottom Sediments in the Black Sea and Sedimentation Rates"]

[Abstract] On the basis of study of materials from 18 cores of the Upper Quaternary sediments in the Black Sea, taken by the scientific research ships of the Southern Division Institute of Oceanology and the Marine Hydrophysical

Institute it was possible to obtain 29 radiocarbon datings. It was found that the age of the surface layer of shallow- and deep-water sediments with a thickness of 3-15 cm is from 100 to 600 years. In addition, it has been established that the bottom of the deep-water late Black Sea sediments has an age of about 3,000 years and the bottom of the ancient Black Sea sediments has an age of about 7,000 years. Several datings were obtained confirming the presence of Upper Pleistocene sediments in the cross section. On the basis of radiocarbon datings it was possible to compute the different mean rates of sedimentation of Late and Middle Holocene sediments which agree with the values obtained earlier for the investigated regions. The rate of recent sedimentation, computed on the basis of radiocarbon datings of the surface layer, usually are above the mean values for the Late Holocene time interval, which, in all probability, is associated with errors in the dating of the most recent sediments.

[531]

#### INCREASING EFFECTIVENESS OF EXPLORATION FOR PETROLEUM AND GAS

Kiev GEOLOGICHESKIY ZHURNAL in Russian Vol 38, No 4, 1978 pp 136-141

[Article by N. Ya. Baranovskaya, N. I. Burylo, V. A. Vitenko, I. N. Golovitskiy and V. P. Pentsak, Ukrainian Scientific Research Geological Prospecting Institute, "Ways to Increase the Effectiveness of Search and Exploration for Petroleum and Gas in the Dnepr-Donets Basin"]

[Abstract] Despite individual shortcomings in study of areas promising for the finding of petroleum and gas, sometimes considerably affecting the quality of reconnaissance and exploration work, almost all the structures detected by seismic prospecting are usually confirmed by drilling. This article is concerned with ways in which to reduce the excessive, costly drilling work which is done in preparing a map of the outline of petroleum and gas basins. The authors discuss the complex analysis which is needed for evaluating the data needed before any drilling work is undertaken. Field investigations, for example, must be carried out at a scale of no smaller than 1:25,000 and the network of profiles on the arches of uplifts should have a spacing of 0.5-0.8 km. The most important problem in exploration is a determination of the rational number of boreholes for the effective outlining of deposits, striving to eliminate excessive numbers of boreholes used in reconnaissance within the contour and totally eliminating profitless holes outside the contour. At present from 2 to 15 holes are drilled to outline a deposit. The article endeavors to show that this task in most cases can be accomplished using as few as two holes.

[531]

#### AEROPHOTOGEOLOGICAL MAPPING OF AREAS COVERED BY SEDIMENTS

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 4, 1978 pp 138-143

[Article by V. B. Sokolova and V. A. Yaduta, Northwestern Geological Administration, "Large-Scale Aerophotogeological Mapping of Territories Covered by Sediments"]

[Abstract] The article gives a definition of a linear-banded photoimage as the basic interpretation criterion in aerophotogeological investigations of territories covered by a sedimentary cover with a thickness up to 60 m. The complex of lines identifiable from the aerial photographs is interpreted as the "preferable orientation" in rocks of the crystalline basement. Each complex of rocks is characterized by its plan of "preferable orientation." In the cartographic image it is grouped into definite directions and forms fields with similar patterns, which makes it possible to detect geological bodies and the time sequence of formation of these bodies. At the same time it was also possible to find a method for mapping intrusive bodies lying beneath strata of surrounding crystalline rocks.

[530]

#### METHODS FOR INCREASING THE ACCURACY OF A BALLISTIC GRAVIMETER

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 4, April 1978 pp 108-117

[Article by L. D. Gik and M. G. Smirnov, Institute of Automation and Electrometry, Siberian Department USSR Academy of Sciences, "Methods for Increasing the Accuracy of a Ballistic Gravimeter Under the Influence of Inertial Accelerations"]

[Abstract] This is in essence a continuation of an earlier paper by the authors ("Response of a Ballistic Gravimeter to Vertical Movements of the Base," GEOLOGIYA I GEOFIZIKA, No 3, 1977). Now the authors have proposed an effective system for vibroprotection of a ballistic gravimeter with deformation, parametrically modifiable in its operating cycle. The article formulates the requirements on instruments which can be used for the introduction of corrections into the results of measurements with a ballistic gravimeter: a) evaluation of the necessary response threshold for an accelerometer gives a value  $\Delta \xi = 10^{-6} \text{ m/sec}^2$ . In application to ground surface gravimeters the method for introducing corrections by accelerometers is extremely difficult; b) the use of a velocimeter makes possible the most natural introduction of a correction into the results of gravimeter measurements by the method of digital integration of the signal from a frequency sensor, which must have a response not less than  $2.5 \text{ KHz}/\mu\text{m}$ ; c) within the limits of its accuracy the use of a vibrometer gives the same effect as a vibroprotection system if their corresponding parameters are identical.

[530]

## EQUIVALENCE PROBLEMS IN INVERSE GRAVIMETRY PROBLEM

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, March 1978 pp 96-107

[Article by P. I. Balk and L. Z. Leont'yeva, Siberian Power Institute, Irkutsk, "On the Problems of Equivalence in the Inverse Gravimetry Problem with Variability of Density"]

[Abstract] A study was made of a class of field sources distributed with polynomial density  $\sigma$  in a volume with the configuration of a hemisphere. It was possible to clarify the structure of the gravity field on a horizontal plane. The unambiguity of solution of the inverse problem as a whole for the studied class is established. Minimum polynomials are derived for describing axially symmetric and axially asymmetric distributions which correspond to zero external fields. It was possible to obtain infinite subclasses of sources having the property of uniqueness and formulas are given for solution of the inverse problem in them. At the same time a study was made of a new class of two-dimensional sources and examples are cited showing the nonuniqueness of solution of the inverse logarithmic potential problem.

[529]

## ELECTROMETRY INDUCTION METHODS FOR PETROLEUM AND GAS BOREHOLES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 4, 1978 pp 86-95

[Article by Yu. N. Antonov, Institute of Geology and Geophysics, Siberian Department USSR Academy of Sciences, "High-Frequency Induction Methods in Electrometry of Petroleum and Gas Boreholes"]

[Abstract] The author gives an analysis of the magnetic field of a vertical magnetic dipole through the generalized parameters of the medium and the apparatus used in the example of a homogeneous medium. It was possible to determine the limits of quasistationary regimes for various methods in measuring the magnetic components of the field. This made it possible to substantiate a more rigorous approach to the selection of design parameters (frequency, length of probe and base length) of borehole instruments for the induction logging of conductivity and the dielectric constant. It was possible to establish the classification possibilities of absolute and relative field characteristics. There is a discussion of the principal aspects of a possible method for investigating radial inhomogeneity in the distribution of resistivity in collecting strata.

[530]



## RESPONSE OF BALLISTIC GRAVIMETER TO VERTICAL MOVEMENTS OF BASE

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, March 1978 pp 112-122

[Article by L. D. Gik and M. G. Smirnov, Institute of Automation and Electrometry, Siberian Department USSR Academy of Sciences, "Response of Ballistic Gravimeter to Vertical Movements of Base"]

[Abstract] A formula is derived for the transfer coefficient for a ballistic gravimeter; it is based on an asymmetric measurement method. The authors have studied the dependence of the mean square error of the ballistic gravimeter on the width of the spectrum of disturbing accelerations. It is shown that on the condition that there is additional narrow-band filtering of vibration noise and an optimum choice of onset of measurement it is possible to achieve a considerable reduction in averaging time necessary for obtaining the stipulated accuracy. The analysis shows that the ballistic gravimeter is suitable for measurements on a moving base only under the condition that use is made of additional means for protection against vibration and when there is mechanical processing of the measurement results.  
[529]

## MECHANISM OF BARRIER SOURCE OF TRANSVERSE WAVES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, March 1978 pp 140-148

[Article by A. V. Trigubov, Institute of Geology and Geophysics, Siberian Department USSR Academy of Sciences, "Mechanism of Barrier Source of Transverse Waves"]

[Abstract] In this examination of the mechanism of a barrier source of transverse waves it was possible to introduce its physical and structural parameters. The author has derived formulas and constructed graphs making it possible to select such a combination of parameters for which the transverse waves radiate not worse (or better) in comparison with a unilinear trench source with a very great trench width. The following are examined: principal parameters of source; resultant formulas for radiation intensities; results of computation of relative intensities; slit barrier source; two-barrier slit source. The formulas and graphs make it possible to evaluate the change in the effectiveness of radiation of transverse waves with variation of the numerical values of the parameters of barrier and slit sources. The parameters themselves are very closely related to the characteristics of the source and properties of the ground. The analysis demonstrates the probability of a higher effectiveness of a two-barrier slit source in comparison with others.  
[529]

## VELOCITY OF ELASTIC WAVES IN URAL BAUXITES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 3, March 1978 pp 149-152

[Article by A. L. Aleynikov, P. P. Lichman, N. I. Nemzorov and N. I. Khal-evin, Geophysical Institute, Ural Scientific Center, and Krivoy Rog Mining Institute, "Velocity of Elastic Waves in Ural Bauxites"]

[Abstract] A study was made of the velocity parameters of bauxites and surrounding limestones in the Urals. The authors demonstrate the closeness of the limits of change and the statistically most probable velocities of the elastic oscillations in the considered rocks and ores. With respect to the velocities of longitudinal (P) and transverse (S) waves the bauxites are characterized by anomalously low values relative to limestones. The article shows that it is possible to differentiate bauxites on the basis of the absolute values of the velocities of P and S waves. The possibilities of seismic prospecting are demonstrated, especially in its mine and borehole variants as described here. The use of seismic research methods in bauxite provinces makes it possible, as is clear from this paper, when there are favorable structural-morphological parameters, to carry out both direct search for ore bodies among limestones on the basis of anomalously low  $v_p/v_s$  values and to differentiate bauxites on the basis of the absolute  $v_p$  and  $v_s$  values.

[529]

## VERTICAL EXTENT OF ALKALINE BODIES AND COMPLEXES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 4, April 1978 pp 38-46

[Article by V. G. Lazarenkov, Leningrad Mining Institute, "Vertical Extent of Alkaline Bodies and Complexes"]

[Abstract] Geological and geophysical data on the depths of alkaline intrusive bodies and complexes are considered. The following subjects are considered: alkaline ultramafic rocks group, alkaline gabbroid rocks group, alkaline granites group, group of nepheline syenites-syenites, syenites-nepheline syenites group. It was found that the observed alkaline bodies and complexes are discovered at different levels in the earth's crust, ranging from near-surface to depths of about 15-20 km. Their distribution by depth facies shows that almost all alkaline formations are represented by complexes of different depth facies. Most of the most important alkaline complexes at the level of the present-day erosional surface bear evidences of formation near the surface or at small depths. The forms in which magmatic bodies are found are a definite indicator of depth of formation. Near-surface alkaline intrusions are usually characterized by a variety of small

forms: necks, sills, annular, conical and radial dikes, small stocks and intrusive bodies of irregular configuration. For some masses of alkaline and ultrabasic rocks it was possible to determine that their lower boundaries lie below the Conrad discontinuity, that is, the roots of these masses penetrate into the "basalt" layer and even into the upper mantle. In the tectonosphere (of the platform type) there appear to be at least two principal stages in the localization of magma hearths: upper, near surface, and lower, deep, corresponding to two main differentiation levels.  
[530]

#### CURVATURE OF FRONT OF SEISMIC WAVE IN LAYERED-GRADIENT MEDIA

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 4, April 1978 pp 118-124

[Article by S. V. Gol'din, V. S. Chernyak and T. V. Kurdyukova, Institute of Geology and Geophysics, Siberian Department USSR Academy of Sciences, "Curvature of Front of Seismic Wave in Layered-Gradient Media (Plane Problem)"]

[Abstract] The objective of this investigation was computation of the radius of curvature of the front of a seismic wave and the second derivative of its travel-time curve during the propagation of elastic oscillations in layered-gradient (to be more precise, layered-one dimensional) media with curvilinear discontinuities. The curvature of the front is easily related to the geometric divergence of the wave and therefore the main field of applicability of this characteristic is a study of the dynamics of seismic waves by the ray method. In earlier studies it was possible to derive formulas describing the changes in the radii of curvature of the front with the reflection or refraction of a wave on a curvilinear discontinuity of two inhomogeneous media. However, until now the change in curvature along the ray within the limits of an inhomogeneous layer has not been considered. The paper discusses the following: 1. Correlation between the curvature of the front and the second derivatives of the eikonal. 2. Recurrent formula for the second derivative of the eikonal. 3. Algorithm for computing the second derivative of the travel time curve for a reflected wave.

[530]

### III. UPPER ATMOSPHERE AND SPACE RESEARCH

#### News

#### "SALYUT-6" MISSION EXPLOITED BY "PRIRODA" CENTER

Moscow OGONYEK in Russian No 28 July 1978 p 30

[Article by L. Desinov: "Space--Earth"]

[Summary] The following is some information supplied by Yuriy Pavlovich Kiyenko, Director of "Priroda" Center, and Aleksandr Denisovich Koval', a section chief at this same center. In discussing the program for the investigation of earth from the orbital station "Salyut-6" it was noted that emphasis is on the so-called territorial productive complexes: the Caspian region; the sectors adjacent to the route of the Baykal-Amur Railroad; the region of the planned shifting of a part of the runoff of the waters of northern rivers to the south of the country. It is very important to trace the change in the shoreline of the Caspian Sea, since it is shoaling. A major place is devoted to study of the geological engineering and seismotectonic conditions of a number of hydroelectric power stations: Abalakovskaya on the Yenisey River, Yelindinskaya on the Katuni River, Namakhvani on the Rioni River and others. In the central and southern regions it is a priority task to study soil erosion... All this requires the training of cosmonauts for making such observations. This professional training is exceedingly important. For this purpose at Zvezdnyy Gorodok there is a scientific laboratory outfitted with modern instructional aids. Theoretical knowledge is embodied in instructional flights in a TU-134 flying laboratory and the objects of the aerovisual observations are those regions which will be studied from orbit. In addition, flights are made over scientific polygons. The scientists of the "Priroda" Center have spent many hours in instructional classes and aboard aircraft with crews of the "Salyut-6" orbital station. They told cosmonauts about the earth's landscapes, about criteria for interpreting different natural features, types of contamination and all types of natural calamities. For example, specialists have formulated methods for identifying the presence of ground water in arid regions. Attention was given to the harmful effects of irrational use of water, such as filtration from channels and salinization of fields... Even ten years ago the water discharge in the lower reaches of the Syrdar'ya was reduced by a factor of more than 10 in comparison with 1958. And in the 1960's alone the area of the Aral Sea decreased by 1/4 and

the level dropped by 170 cm. This is the sort of phenomenon which is best studied from space...Repeated surveys of the earth's surface are made for studying the dynamics of natural phenomena. In the case of perennially or seasonally snow-covered areas, such observations are of great interest to hydrologists who predict the runoff of mountain rivers...In observing cloud-covered areas the camera is triggered only in those cases when the cloud cover over the surveyed region does not exceed 3/10...In studying the ocean attention is being given to water color. For example, there is a color scale aboard the "Salyut-6." But in the opinion of the cosmonauts, the color pattern of the ocean is brighter and more diversified. The water color in the sea is dependent on its temperature, salinity, presence of plankton and all contaminants. It is also related to bottom relief and content of trace elements in the ocean... Space observations will play a major role in monitoring the purity of the seas and oceans. Today the methods for detecting spots of petroleum products and other contaminants are only being developed, but soon we will be witnesses of the regular use of manned spaceships for this purpose.

[518]

#### CHRONOLOGY OF "SALYUT-6" MISSION 23 JULY-4 AUGUST 1978

[Editorial Report] Moscow PRAVDA in Russian, dated 25 Jul 78 through 5 Aug 78, TASS provides the following information on flight activities on board the manned "Salyut-6" space station:

##### 23 JULY

In accordance with the program to study earth resources, cosmonauts Kovalenok and Ivanchenkov photographed various areas of the earth's surface, including the Crimea, the Caucasus, the South Urals, Kazakhstan and Central Asia.

They also conducted two materials processing experiments: one in the "Splay" furnace to obtain new semiconductor materials and compounds of aluminum, tin and molybdenum, and the second in "Kristall" to grow a gallium arsenide monocrystal from a high-temperature solution. (PRAVDA 25 July 78 p 1)

##### 24 JULY

This was a day of "active rest." In addition to their daily exercise on the bicycle ergometer and the comprehensive trainer, cosmonauts Kovalenok and Ivanchenkov tested the on-board systems of the station and of the "Progress-2" and "Soyuz-29" transport ships. (PRAVDA 25 Jul 78 p 1)

##### 25 JULY

[No information published]

## 26 JULY

26 July marked the end of the sixth week of the orbital flight of the "Soyuz-29" crew.

Throughout the day, Cosmonauts Kovalenok and Ivanchenkov tested various on-board systems and installations, prepared equipment for future work and conducted visual observations of the earth's surface.

The next in the series of experiments to produce semiconductors in "Kristall" had been completed. This particular one was an effort to obtain crystals from the vapor phase and did not permit them to touch the walls of the ampules as they solidified. The maximum temperature of the original materials to be processed reached 1100 degrees Centigrade.

According to medical data, the pulse rate of commander Kovalenok was 68/minute, of engineer Ivanchenkov -- 65/minute; their blood pressures were 120/70 and 125/70 respectively. (PRAVDA 27 Jul 78 p 1)

## 27-28 JULY

According to trajectory measurement data, the orbital parameters of the "Salyut-6"--"Soyuz-29"--"Progress-2" space complex were:

- apogee, 346 kilometers;
- perigee, 328 kilometers;
- period of revolution, 91 minutes;
- orbital inclination, 51.6 degrees.

The parameters of the microclimate within the station were given as follows:

- temperature, 20 degrees C;
- pressure, 770 mm Hg.

Cosmonauts Kovalenok and Ivanchenkov continued to photograph the earth's surface, including Belorussia, the Ukraine, the Sal'skaya steppe and the Caspian Lowlands. They also conducted further biological experiments to study the effect of prolonged spaceflight on the development of a variety of plants. (PRAVDA 29 Jul 78 p 1)

## 29 JULY

### 2-HOUR EVA

On 29 July at 0700 hours Moscow time cosmonauts Kovalenok and Ivanchenkov opened a hatch on the transfer compartment and for 2 hours 05 minutes conducted operations to dismantle various test instruments and to remove a number of biological and materials samples from the outside of the "Salyut-6" station. Wearing special semirigid spacesuits during their EVA, they also successfully installed on the station a new device to register cosmic radiation and prepared a television broadcast as well.

Upon the completion of their work in outer space, they returned to the transfer compartment of the station, closed the hatch and repressurized the cabin. The materials and equipment removed from the outside of the "Salyut-6" will be returned to earth for study; this successful EVA "opens extensive possibilities to use outer space for increasing scientific research on future manned orbital complexes."

[The article is accompanied by a photograph of cosmonaut Ivanchenkov during the EVA.] (Pravda 30 Jul 78 p 1)

#### 30 JULY

#### 31 JULY

#### 1 AUGUST

#### 2 AUGUST

At 0757 hours Moscow time the "Progress-2" automatic freight transport ship undocked from the "Salyut-6"---"Soyuz-29" complex. The craft had been docked with the space station for 25 days and had supplied "Salyut-6" with fuel, new equipment, food, etc. Cosmonauts Kovalenok and Ivanchenkov carefully monitored the undocking and subsequent testing of "Progress-2" on-board systems. (PRAVDA 3 Aug 78 p 1)

#### 3 AUGUST

Cosmonauts Kovalenok and Ivanchenkov conducted another "Kristall" experiment, processing a germanium monocrystal by the "directional method." (PRAVDA 5 Aug 78 p 1)

#### 4 AUGUST

The "Progress-2" automatic freight transport ship burned up as it braked and entered the dense layers of the atmosphere. (PRAVDA 5 Jul 78 p 1)

All of the TASS reports indicate that the cosmonauts are well and that all on-board systems are functioning normally. TASS information on flight activities for 25 July and 30 July-1 August was not published in the Soviet press. [5]

[520]

TASS ANNOUNCES LAUNCHING OF "KOSMOS-1028"

Moscow PRAVDA in Russian 7 Aug 78 p 3

[TASS Report: "'Kosmos-1028'"]

[Abstract] The artificial earth satellite "Kosmos-1028" was launched in the Soviet Union on 5 August 1978. The satellite was inserted into an orbit with the following parameters:

- initial period, 88.7 minutes;
- apogee, 272 kilometers;
- perigee, 182 kilometers;
- orbital inclination, 67.1 degrees.

[525]

#### ORIGINS OF LIFE SOUGHT IN "SALYUT-6" EXPERIMENTS

Moscow IZVESTIYA in Russian 3 Aug 78 p 3

[Article by B. Konovalov: "Parting With the Transport Ship"]

[Excerpt] During their EVA, cosmonauts V. Kovalenok and A. Ivanchenkov removed and brought on board the station cassettes from the "Meduza" experiment, one which has a direct relation to the origins of life on our planet.

Specialists at the USSR Academy of Sciences' Institute of Cytology decided to look at the effects of prolonged exposure to open space and cosmic radiation on four of the twenty amino acids that serve as the "building blocks" of living things on our planet. Each of the sets was placed under different conditions: one was exposed only to the effect of cosmic radiation and the second was also exposed to ultraviolet radiation; the third, on the other hand, was buried and screened from open space. Ground-based experiments have shown that under the influence of ultraviolet and cosmic radiation and electrical charges, the molecules of amino acids become chemically active and form long polymer chains. Now, this same occurrence under natural cosmic conditions would be a significant confirmation of the possibility of the formation of prebiological compounds in space and the subsequent autogenesis of life on other planets.

In another set of cassettes also exposed to open space for ten months, precursors to DNA and RNA molecules underwent similar tests. Scientists are interested in discovering whether polymer strands of RNA and DNA molecules will be created out of this "raw material." [5]

[524]

#### PSYCHOLOGICAL SUPPORT FOR "SALYUT-6" MISSION COSMONAUTS

Moscow PRAVDA in Russian 9 Aug 78 p 3

[Article by USSR Deputy Minister of Health A. Burnyazan and Flight Director, Pilot-Cosmonaut and Twice Hero of the Soviet Union A. Yeliseyev: "Psychological Support in Space"]



[Text] The extended flights of cosmonauts on orbital stations has presented specialists in the field of space medicine with new problems. Under these conditions space psychology has assumed an even greater significance. In addition to known arrangements for the rational organization of work and rest (such as synchronizing activity with Moscow time), it makes use of an entire set of psychological support measures.

The purpose of them is, together with systems of social, psychological, pedagogical and other measures, is to promote very effective work on the part of the cosmonauts throughout their flight and the complete fulfillment of all tasks. This is especially important as flight programs become more complex and include not only scientific experiments but also such demanding operations as EVA, meeting "visiting expeditions" and docking with automatic freight transport ships.

Space psychology has accumulated sufficiently great experience by studying the behavior of man under simulated spaceflight conditions. It has been shown that prolonged residence in a closed habitat and isolation from familiar earth conditions entails changes in his overall state of being. This gives rise, in a number of cases, to a deterioration of mood and a drop in interest in the research being conducted.

Taking this into account, psychological support first for cosmonauts Yu. Romanenko and G. Grechko and then for V. Kovalenok and A. Ivanchenkov was -- and is -- drawn up with regard to the flight program, living conditions on board "Salyut-6" and ideas about the individual psychological peculiarities of the crew members. It is directed, first and foremost, to satisfying the priority demands, tastes and customs of each of them. Such an approach, we believe, ensures a high level of interest in the work and a favorable psychological atmosphere on board and in relations with ground specialists.

For example, with the tastes and customs of the cosmonauts in mind, menus were varied, music to accompany radio communication sessions, physical training and research was selected, and their leisure activities were planned.

For the first time, the cosmonauts are using a videotape machine with a wide selection of video and musical programs. At their disposal are a library and a record collection. This makes it possible for each of them to enjoy their leisure and to satisfy their vital needs most completely.

The videomusical program "The Magic Lantern" is especially popular among cosmonauts. This stable interest is one means of confirming overall good health. Stability in preferences is a reliable symptom testifying to the proper support and rehabilitation of the crew.

Extended flights are linked with monotony. Thus, it follows that there must be a rigid alternation of professional tasks and rules for conducting radio communications sessions in a so-called "standardized language." Videomusical

programs and familiarity with major political events and reactions by the national and foreign press to the "Salyut-6" flight fulfill the lack of influences and ameliorate the feeling of isolation by bringing life on board the station closer to familiar conditions. Particularly effective in this respect is an effort by a group involved with psychological support to arrange radio interviews with journalists, scientists and stars of the stage and screen.

Contact with the cosmonauts' own families and with those dear to them has a special significance of its own in the program for psychological support. It does not only relieve the cosmonauts' anxiety about the lives of their families: friends and relatives of the cosmonauts sometimes detect the finer nuances of mood and condition and can give valuable advice to flight directors and specialists.

The "visiting expeditions" were great emotional events for Yu. Romanenko and G. Grechko. By their very presence on board (and this is not to mention the mail and parcels they delivered), V. Dzhanibekov and O. Makarov and then A. Gubarev and V. Remek gave strong psychological support. In one of his reports G. Grechko clearly expressed this: "We, of course, are stunned by this meeting in space; we want to work still more and better..." V. Kovalenok and A. Ivanchenkov repeated this same thought after their orbital meeting with P. Klimuk and M. Hermaszewski.

The flight of the "Salyut-6" orbital station is continuing. Day after day the cosmonauts fulfill the flight program. Doctors and psychologists who in their daily work support the selfless work of the cosmonauts are of great service to this endeavor. [5]

[526]

#### COMMENTARY ON "PROGRESS-2" MISSION

Moscow PRAVDA in Russian 3 Aug 78 p 6

[Article by A. Pokrovskiy: "The Transformation of the Complex"]

[Summary] "There is separation!" -- these are the words which today completed the flight of the scientific research complex "Salyut-6"- "Soyuz-29"- "Progress-2." From now on the path in circumterrestrial orbit is occupied only by the complex "Salyut-6"- "Soyuz-29." Its former companion -- the transport freighter "Progress-2" is to enter into the dense layers of the atmosphere over a stipulated region of the Pacific Ocean. In the finishing stage of its existence the ship will perform a final function -- annihilation in the atmosphere of the wastes accumulated in the complex. This includes worn-out air regenerators, absorbents, filters and different kinds of packing materials. The cosmonauts had expended part of the air on the complex during their

emergence into space; this was replenished by supplies which had been brought by the freighter. And the new apparatus which the cosmonauts attached to the outer surface of the "Salyut-6" had been brought by the same freighter. The MKF-6M system for surveying the earth's surface was loaded with film brought by the "Progress-2." In contrast to any other transport means, the "Progress-2" formed a single whole with its "port," making it possible to judge not only the attainments of present-day practical cosmonautics, but also to foresee the future... On the evening before the undocking there was a series of technical tests under the "Rezonans" program. The purpose of these tests was a study of the dynamic characteristics of the orbital complex and a determination of the magnitude of the loads acting upon it. These tests are very important. After all, the modular assembly principle is one of the most likely ways in which large structures can be created in space. That is why it is necessary to know the regularities of behavior of space constructions when the loads change, in this case after the docking of the "Progress-2."

[523]

#### "SALYUT-6" MISSION EVA DESCRIBED

Moscow TRUD in Russian 30 Jul 78 p 3

[Article by V. Golobachev: "Leaving the Space Home..."]

[Text:] Yesterday Vladimir Kovalenok and Aleksandr Ivanchenkov emerged from the orbital station into open space.

In accordance with safety rules, prior to emergence into space the cosmonauts placed in the descent module the results of the investigations and experiments and ordinary spacesuits in the case of an emergency landing, if, for example, there was a depressurization of the entire station. However, the probability of this is negligible. During the time of emergence the main, working compartment of the "Salyut-6" and both living compartments of the ship are sealed tightly by hatches. And the small transfer compartment with the hatch into open space serves as a sort of lock.

Upon emerging from the hatch the cosmonauts in principle can go around the outside of the entire station. On the trainer at Zvezdnyy we mentioned the handrails extending to the right and left from the "Salyut-6." By holding onto them it is possible to reach the most important elements of the orbital home. Even before the launching of the station the specialists decided upon five possible paths of movement over the "Salyut-6" surface. Some of the paths can be used in emergency, unforeseen situations. For example, if the cover of a telescope has not opened or not closed the cover can be approached along the first path. If the panels of solar cells have not opened, they can be reached along the second path. The third path can be used

for inspecting the surface of the solar cells if their productivity has been sharply reduced. And if the covers of the locks through which the containers with the wastes are eliminated into space become wedged, a fourth path has been laid out. Fortunately, until now there has been no need for these paths. Grechko and Romanenko used a sixth, earlier unplanned variant, when emerging into open space through the dock, since this was more convenient. But yesterday the work proceeded as usual, using the fifth program -- work on the outside in the neighborhood of the transfer compartment hatch.

...They laid down to sleep on Friday during the daytime and awoke yesterday, as was planned, at midnight. They had breakfast and checked the operation of the on-board systems. At six in the morning the earth decided to proceed to operations for donning spacesuits. Having done this, the cosmonauts carefully checked them for tightness and reported to earth that they were ready for emergence.

Opening a valve, the commander and ship's engineer began to exhaust the air from the transfer compartment into space. The pressure rapidly and smoothly dropped.

At seven o'clock in the morning they opened the hatch into space. In a businesslike manner, calmly and as if it was an everyday matter, they presented their report. But here, at the Control Center, some excitement was felt, some feeling of joyous elation.

Thirteen years ago Aleksey Leonov for the first time emerged into open space. Now space is becoming a work place for the pilots of star ships.

Aleksandr Ivanchenkov was the first to begin to float smoothly from the station.

"Don't hurry, there is no need for it!" warns Kovalenok.

Ivanchenkov emerged, freed the small "Yakor'" [anchor] platform from the lock from the outside of the station ("dismounted it," as the specialists say); this was for them to stand on. At the back of the spacesuit boots there were special "spurs" which make it convenient to hold tight and in front there is a projection. It is very convenient for work outside the station: it is easy to move along a special railing on the platform and the cosmonaut can hold on securely.

Vladimir Kovalenok emerged from the hatch behind the ship's engineer. Both acted clearly and calmly. At this time they were flying over the earth with a velocity of more than 28,000 km/hour...

The cosmonauts mounted a light on top, connected the electric plug and switched on the color television camera. One of the tasks during the time of work in space was the collection of samples of materials attached to the outside of the station. These materials include rubbers, elastics and

others which are being used in space technology. The samples have spent ten months in space, where almost every hour the temperature changes from plus 70 degrees to minus 70 degrees, under conditions of a deep vacuum and radiation fluxes. How have the materials intended for the sealing of different units and junctions in space stood up?

Also subjected to testing in space were special paints, metallic coatings and construction materials -- Dural, titanium, steel, and also glass and optical elements. How rapidly do they age, being on the outside of the station? It is important that builders have an answer to this question. Ivanchenkov demounted a part of the samples and handed them to Kovalenok. Then he received new ones from the commander and attached them to the station.

Investigations of the intensity of meteor fluxes are of special interest. Flat panels were installed on the transfer compartment of "Salyut-6" for the registry of micrometeors. It is important to know not only their size, but also their velocity. Even a relatively small particle, flying at an enormous velocity, will penetrate armor. The mean velocity of a particle is estimated at 20 km/sec (but in general the velocity varies from 2 to 72 km/sec). On the earth it is impossible to obtain for experiments any particles which simulate micrometeors and which move at more than 10-11 km/sec. Above this velocity is a mysterious zone which is forbidden for scientists, a region of hypotheses and guesses. But it is necessary and important to know this. After all, as a monthly average about 500 micrometeors are registered by the station. "Pits" appear on the windows: these are the traces of micrometeor impacts. Evidently, particles with a diameter up to 200 microns have struck. The station and ship, according to the calculations of specialists, are reliably protected against penetration. The cosmonauts removed one of the panels and it will be returned to the earth. Unique data were obtained; never before has there been a study of materials which have been so long exposed in space.

The work program for Kovalenok and Ivanchenkov outside the orbital complex also included the replacement of the biological samples mounted on the outside. Among these are samples of skin from man, animals and lizards, as well as strains of microbes. What effect was exerted on the samples by radiation and the severe conditions of space? The cosmonauts collected some samples and replaced them with others for continuation of the experiment.

Finally, the last task performed by the commander and the ship's engineer was the installation of a new system for the registry of the hard x-radiation emanating from the depths of space. There are such instruments within the station. But they register that which passes through the walls of the "Salyut-6." But what is the intensity of the rays on the outside and how effective is the shielding? These questions are of interest to designers.

At 0809 hours the cosmonauts switched on the television cameras and we saw a surprising report from circumterrestrial orbit, from open space.

"It is pleasant to work here," says Vladimir Kovalenok.

"Yes, in actuality we are happy to be in space," notes Ivanchenkov.

"And warm our hands in the sun," notes Kovalenok.

"Have you opened the valves of the heat-regulating system on the sleeves in order not to get overheated?" asks the operator at the flight control center at once.

"We did so," notes the commander.

It can be heard how heavily he is breathing; work in space is no easy matter.

Using a modern camera, the cosmonauts made a survey of the earth. We will see these frames when the film is delivered to the earth, is processed and developed...

The cosmonauts and specialists on earth are constantly checking the pressure in the spacesuits, the pressure in the oxygen cylinders, its expenditure, whether or not there is a leak... The doctors are watching the electrocardiogram, pulse rate and body temperature (it is measured simultaneously at several points)... Everything is going normally.

The work outside the station provided for by the program has been completed. At 0905 hours the cosmonauts return to the transfer compartment and seal the hatch...

They worked superbly and naturally were fatigued. The work was done successfully. A new and glorious page has been written in the heroic annals of the mastery of space.

[522]

#### COMMENTARY ON "SALYUT-6" FOOD SELECTION

Moscow IZVESTIYA in Russian 12 Aug 78 p 2

[Article by B. Konovalov: "The Cosmonauts' Menu"]

[Summary] The "Progress-3," as usual, brought new supplies of film, various kinds of equipment, instruments and replacement components for the life support system. But in comparison with preceding freighters, the third "Progress" was loaded with more water and food. Space accentuates all sensations, including taste sensations. The cosmonauts have a diversified diet. The menu is repeated only once each six days so that they will not become weary of their food. The "Progress-3" brought more than 60 food items, and in addition, 25 dishes sent on the special request of V. Kovalenok and

A. Ivanchenkov. The creation of space food is no simple matter. It must correspond to many contradictory requirements. It must be tasty, high in calories and be well balanced with respect to proteins, fats and carbohydrates and at the same time withstand storage for a long time without refrigeration, be convenient for use under weightlessness conditions, weigh as little as possible and occupy little space. Entire institutes are working in order to solve this problem successfully and to prepare increasingly more tasty dishes for cosmonauts. One of these institutes is the All-Union Scientific-Production Combine of the Canning Industry and Special Food Technology; it prepares foods which are carried aboard. All the food is prepared for consumption under weightlessness conditions. After all, an ordinary liquid soup would be dissipated throughout the spaceship. Soups are therefore made in puréed form. None of this came about easily. It required the efforts of many specialists. For example, it was difficult to prepare a simple beverage like coffee and milk. When the tubes of prepared coffee were pasteurized in an autoclave the milk curdled and was lumpy. Specialists took cow's milk from an early morning milking and carried out special tests. It was found that if the cows had been frightened before milking the milk was unsuitable for pasteurization. Therefore, the milk had to be taken from calm cows. Specialists work directly with the cosmonauts and after each flight they are debriefed concerning their food impressions. Every effort is made to make their difficult life in orbit easier.

[527]

## Abstracts of Scientific Articles

### SUN'S MAGNETIC FIELD AS SOURCE OF COSMIC RAY MODULATION

Moscow IZVESTIYA AKADEMII NAUK SSSR, SERIYA FIZICHESKAYA in Russian Vol 42, No 5, 1978 pp 927-929

[Article by A. N. Charakhch'yan, G. A. Bazilevskaya, Yu. I. Stozhkov and T. N. Charakhch'yan, Physics Institute USSR Academy of Sciences and Scientific Research Institute of Nuclear Physics, Moscow State University, "The Sun's General Magnetic Field as a Source of Cosmic Ray Modulation"]

[Abstract] Experimental data now make it possible to obtain some information on the intensity of modulation of galactic cosmic rays by the sun's general magnetic field. It can be assumed that the greatest increase in the intensity of primary cosmic rays  $\Delta$  during 1971-1972 corresponds to the period when the general magnetic field in the process of pole reversal assumed a minimum value. Therefore, the measured  $\Delta$  value in the first approximation is the total effect of cutoff of primary cosmic rays due to the sun's general magnetic field. The results of  $\Delta$  determinations on the basis of stratospheric observations show that the intensity of modulation by the general magnetic field is approximately 40% of the intensity of primary cosmic rays during the period of its maximum (1965). In other words, the sun's general magnetic field decreases the intensity of galactic cosmic rays by approximately 40% (for a hardness  $R \geq 0.5$  GV). The article discusses the energy spectrum of modulation. It appears that in the future, on the basis of data on the modulation of galactic cosmic rays, it is also possible to obtain information on some global characteristics of the heliomagnetosphere and obtain more precise results concerning the energy spectrum of cosmic rays in interplanetary space. The principal difficulty is the reliable separation of modulation effects associated with the 11-year cycle of spot formation on the sun and with changes of the sun's general magnetic field. [This paper is from Materials of the All-Union Conference on Cosmic Rays (Yakutsk, June 1977)] [487]



#### ERROR IN REPRESENTING FIGURE OF GEOID FOR EVALUATING AES POSITION

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 2, 1978 pp 35-37

[Article by L. P. Pakhmutov, "Influence of Error in Representing Figure of Geoid in Evaluating Geocentric Position of Artificial Earth Satellite"]

[Abstract] The article presents the results of experimental investigations of a method for taking into account the influence of the earth's anomalous gravity field on the motion of an artificial earth satellite as a function of heights of the geoid proposed by Professor M. M. Mashimov. The motion of an artificial earth satellite is described by a system of particular differential equations in osculating elements which is solved by the Runge-Kutta method. The magnitude of the error in the geocentric radius of the satellite is expressed as a function of the corrections in preliminary heights of the geoid. It is shown that on short arcs it is possible to neglect the influence of anomalies in the heights of the lower hemisphere relative to the position of the artificial earth satellite. The conclusion is drawn that the method of discrete representation of the perturbing potential in elementary areas proposed by M. M. Mashimov is rigorous.

[532]

#### COORDINATE SYSTEMS FOR MAPPING PLANETS AND SPACE NAVIGATION

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 6, 1978 pp 16-21

[Article by Ye. P. Aleksashin and Yu. S. Tyuflin, "Planetocentric Coordinate Systems for the Mapping of Planets and Space Navigation"]

[Abstract] The authors examine planetocentric coordinate systems used at the present time for the mapping of planets and in navigation between planets. The article describes a new system of parameters stipulating the orientation of planetocentric and geocentric coordinate systems which makes it possible to form matrices describing transfer between planets using a single algorithm, regardless of the direction of planetary rotation. Also given are the derivations of formulas for computing the elements of the transfer matrices. Some recommendations are given on the programmed use of these formulas with electronic computers.

[533]

## REFINING TOPOGRAPHIC DIRECTION OF ARTIFICIAL SATELLITE

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, GEODEZIYA I AEROFOTOS"YEMKA in Russian No 2, 1978 pp 97-99

[Article by Ye. P. Gubanova, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "Refinement of Topographic Direction of Artificial Earth Satellite on the Basis of the Theory of Infinitely Small Rotations"]

[Abstract] At the present time in geometric space geodesy methods the process of mathematical processing of satellite astronegatives is basic in determining the topocentric vector-direction to an artificial earth satellite. But in addition to traditional methods, it is of scientific and practical interest to investigate a processing method based on projective transformations. An obvious advantage of this sort of method is an invariance of the results of determinations of the sought-for vector-directions relative to the misadjustment of the measuring instrument, such as nonperpendicularity of its guides and nonuniform deformation within the limits of projective transformations. In addition, there is a considerable simplification of the computation process. This article gives a method for refining the topocentric equatorial coordinates of the object to be determined. The method is based on the condition of collinearity of the reference vector-direction to a star (closest to the object) and the computed vector-direction. The procedure for refining the topocentric equatorial coordinates for the object to be determined essentially involves computation of the instantaneous vector of rotation  $\bar{q}$ . This procedure is examined in the example of one object to be determined. Since in actual practice the number of reference stars used in the refinement is greater than one, the problem of determining the instantaneous vector of rotation  $\bar{q}$  must be solved by the least squares method with an evaluation of accuracy.

[532]

## EFFECT OF ATMOSPHERIC LIGHT SCATTERING ON CHOICE OF SPECTRAL ZONES

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 6, 1978 pp 22-25

[Article by Yu. V. Krylov, "Effect of Atmospheric Light Scattering on the Choice of Spectral Zones"]

[Abstract] In choosing spectral zones for multizonal space surveys it is necessary to take into account the atmospheric effect on radiation carrying information on the earth's surface. If this effect is not taken into account the zones selected on the basis of an analysis of the spectral reflective characteristics of the surface may not be optimum for studying the earth from space. In this article the author gives a comparative analysis of the choice of spectral zones, with and without allowance for the

influence of the atmosphere. The paper gives the results of such a comparison for the visible part of the spectrum 450-700 nm. Attention is given only to light scattering by the atmosphere and absorption is not considered (in the visible part of the spectrum the influence of absorption is weaker). The considered class of objects combines four types of surfaces: chernozems and sandy loams, podzolized and clayey loam soils, sands and different exposures in the desert, limestone, clay and other light objects. Using one and the same determination criterion, the spectral zones computed for the level of a spacecraft orbit differ from the zones computed for the level of the earth's surface by a displacement of the first toward the long-wave limit of the considered range as a result of the influence of light scattering in the atmosphere. The lesser the atmospheric transparency or the solar altitude, the greater is this displacement. When light scattering is taken into account there can be a change in the number of spectral zones. For example, with a combination of limestone, clay-sand, desert exposures one obtains: for the surface level -- one zone 450-554 nm, for orbital level -- two zones 472-574 and 643-700 nm. For a combination of podzolized and clayey loam soils - chernozem and sandy loam, at the surface there are two zones 560-620 and 665-700 nm and at orbital altitudes -- one zone 563-700 nm.

[533]

#### IV. MISCELLANEOUS

##### News

##### OFFICIAL PREVIEWS 24TH SOVIET ANTARCTIC EXPEDITION

Leningrad LENINGRADSKAYA PRAVDA in Russian 10 Aug 78 p 4

[Interview with V. N. Petrov: "The 24th Antarctic Expedition"]

[Text] The 24th Soviet Antarctic Expedition is preparing for a long voyage, Candidate of Geographical Sciences V. N. Petrov, Party Committee Secretary at the Arctic and Antarctic Institute, made the following comments in a talk with your Leningradskaya Pravda correspondent:

"The 24th Expedition, which will be led by Doctor of Geographical Sciences Professor Yevgeniy Sergeyevich Korotkevich, Honored Scientific Worker of the RSFSR, will be one of the largest in terms of numbers and the importance of the tasks it has been set. Apart from the continuation of the scientific vigil, the winter and seasonal personnel will perform a number of important acts, in particular, in the western Antarctic. An attempt was made several years ago and two small buildings were constructed there, but now the Rus-skaya station is to be the center of operations. In the first year there are plans mainly to conduct meteorological and glaciological observations. There are plans to construct the first stage of an airfield at Molodezhnaya, whose landing strip in the near future will be able to take heavy wheeled aircraft."

"The journeys of tracked sledge trains will be continued. Apart from the traditional journey to carry supplies to the Vostok station another two journeys will be made, from Mirnyy to Komsomolskaya over a distance of 871 km and from Mirnyy to Pionerskaya and the region of the so-called "C" dome over a distance of 1,400 km. Both journeys are being undertaken under the program of the "International Antarctic Glaciological Project," in which our country is a participant. During the journeys the scientists will carry out another program entitled "The Geophysical Polygon in the Ant-arctic."

"In connection with the development and intensification of operations in environmental protection, there are plans to organize a special monitoring service at either Mirnyy or Molodezhnaya (depending on circumstances). Its aim will be to investigate the composition of the atmosphere, precipitation and the snow cover. There are plans to continue the seasonal geological, geophysical and surface geodetic operations in the region of the Weddell Sea and the Filchner Ice Shelf."

"Foreign scientists are included in the 24th expedition. At the Novolazarevskaya station there will be seven research workers from the GDR: two Polish biologists will be assigned to Mirnyy; an American will winter at Vostok and an Australian scientist will also participate in operations."

"The expedition has a strong maritime squadron. The scientific research ships 'Professor Vize' and 'Professor Zubov' will carry out a substantial number of observations under the 'Poleks Yug' program. Apart from the 'Mikhail Somov' and the two scientific ships mentioned above, there are plans for several more ships to take part, including a tanker which will deliver 10,000 tons of fuel to the south pole stations."

The departure of the first ship in the 24th Soviet Antarctic Expedition, the passenger liner "Bashkiriya," is scheduled for mid-October. The process of staffing the seasonal detachments and personnel for the stations is now nearing completion. Party groups are being formed which will be led by the most experienced and hardened Communist polar workers. Materials are in the process of being prepared for the system of political enlightenment and economic education.

The expedition collective is filled with determination to fulfill all the tasks it has been set.

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